ILC RDR Magnet
Systems Group

SLAC Meeting
Tuesday, April 25, 2006

Magnet Input Data
'magnet data sheets'

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Magnet Data Sheets

- **Extract from Machine Physicist as much information as needed (possible) to define magnet parameters to allow a conceptual design for the magnet and its system; e.g.,**
  - **Main Harmonic**
  - **Strength – integral of main harmonic along magnetic axis**
  - **Aperture**
  - **Field quality – non-uniformity allowed expressed in terms of multipole components**
  - **Alignment**
  - **"Stringing" – is it in series with other magnets or individually powered**

Magnet Data Sheets, cont.

- **Data sheets developed by Sugahara & Spencer, and Tompkins & Kashikhin, and others.**
  - **Several iterations**
  - **Discussions with Area Leaders**
  - **Ultimately, we will accept information in any format**
    - **we get it; and,**
    - **all the information is there**
  - **Distribution to Area Leaders on March 20, 2006**
  - **First sheets received**
    - **RMTL - April 13, 2006**
    - **BDS - April 20, 2006**
    - **Main Linac – April 21, 2006**
  - **Iteration under way**
    - **Corrections**
    - **Discussions of basic parameters**

Magnet Data Sheet

Lattice

- Beamline name (location of use)
- Quantity required
- Magnet type (main harmonic)
- Integrated Strength of field
  - Effective length
  - Layout [center(X,Y,Z), Slot length]
  - Sagitta for dipoles (value, tolerance - if required)
- Number required
- Stage 2 (1 TeV CM) requirements
  - Field strength
  - Effective length

Magnet Data Sheet

Magnet Characteristics

Bore diameter or full gap (x,y apertures)

Reference radius (to define 'good field' region)

Normal/superconducting?

Field Tolerances:

on main component (for magnets in strings)

on multipole components

Limit on maximum field/pole tip field ?

Additional magnetic component(s) (e.g., trim coils if integrated with main harmonic)

Integrated Strength of field(s)

Tolerance on multipole components

Magnet Data Sheet

Alignment Tolerances (installation)
- position (magnetic center)
- pitch, yaw, roll (magnetic axis)

Alignment Tolerances (beam based)
- position (magnetic center)
- pitch, yaw, roll (magnetic axis)
- Method: steering dipole or magnet mover

Operational characteristics
- Field: nominally constant or varied?
  - If varied, what field range & dB/dt
  - For kickers: rise time and flattop duration
- Unipolar or Bipolar
- Individual control or series ('string')

Other requirements
- Mover?
  - Step size, accuracy
- Special supports?
- Any other requirements?

Magnet Data Sheet

Notes:

Integrated Strength

The integrated nominal field over length; the nominal field is the value used to determine magnet design. If the field is to be varied, please indicate the maximum strength which will be required.

Field uniformity/tolerances

Typically expressed in normalized harmonic 'units' $(B_n/B_{fund})*10^4$ at the reference radius, where 1 "unit" = 10^{-4} of the fundamental. It could be expressed as an integral deviation from the desired field, but typically the beam is more sensitive to specific components which should be identified. The reference radius is typically 2/3 of the physical aperture. 10^{-3} units (at 1 cm) is a typical limit; open for discussion.
Tolerance on the main component: the rms deviation of the strength of the ensemble of nominally identical magnets run as a string; e.g., in the e+ xfer line

Magnet Data Sheet

Stage 1 vs. Stage 2

The BDS is (according to the BCD) designed for Stage 2 (1 TeV CM energy) but most of the verbal direction has been to reduce cost by only leaving space for Stage 2 components. The other areas (to our knowledge) are to be designed for Stage 1 (500 GeV CM). This will need further clarification.)

Special Magnets

Wiggler, undulator, septum, and kicker magnets do not necessarily fit as well into the structure of this table; please modify it as necessary to meet the requirements of these elements

Jargon

Slot length: maximum alloted length along beam line
Trim coils: lower strength steering or correction coils (e.g., dipoles)
Axis: magnetic axis - pitch, yaw, and roll in surveyors terms - related to external fiducials
Effective Length: integral of field over length (strength)/nominal field value